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REBUTTAL REPORT

OF

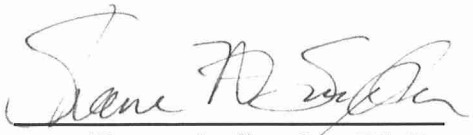
SHANE A. SNYDER, Ph.D.

In the matter of:

West Virginia Rivers Coalition, Inc. (Plaintiffs)
Little Hocking Water Assn, Inc. (Plaintiff-Intervenor)
v.
The Chemours Company, FC, LLC (Defendants)

(Civil Action No. 2:24-CV-00701, US District Court – Southern District of West Virginia)

21st July 2025



Shane A. Snyder, Ph.D.

The Chemours Company FC, LLC (Chemours) engaged me to provide an expert opinion (rebuttal) on the report filed in this matter by Dr. Issam Najm, Water Quality & Treatment Solutions, Inc., dated 4th July 2025 and corrected 7th July 2025.

In developing my opinion, I relied upon manuscripts from published literature, government reports, information provided by the defendant, and professional experience to generate this rebuttal report. A list of materials reviewed and considered is provided within this report.

The opinions stated herein are the product of reliable scientific principles and are offered to a reasonable degree of scientific certainty, which have been accurately applied to the facts of this case. I reserve the right to amend or supplement this report as additional information is received. I am compensated at an hourly rate of $475/hour that is independent of any verdict or settlement of the complaint.

QUALIFICATIONS

A current *curriculum vitae* (CV) containing publications and research projects is provided in Attachment A. I am a Senior Consultant with Total Environmental Solutions, LLC (TES), Tucson, Arizona. I have conducted environmental research for more than 30 years and have acted as an environmental consultant in various capacities during my professional career. Aside from my role at TES, I am also a tenured-full Endowed Chair Professor within the School of Civil & Environmental Engineering at The Georgia Institute of Technology (Georgia Tech), Atlanta, USA. I was formerly the President's Chair Professor of Water Technologies at Nanyang Technological University, Singapore (NTU) and the Executive Director of NTU's Nanyang Environment &

Water Research Institute (NEWRI). Prior to NTU, I was a tenured-full Professor of Chemical & Environmental Engineering at the University of Arizona, Tucson and the Co-Director of the University of Arizona's Water & Energy Sustainable Technology Center (WEST). From 2000 through 2010, I was the Research and Development Project Manager for the Southern Nevada Water Authority (SNWA) in Las Vegas, Nevada. SNWA provides public water services for the residents and visitors to Las Vegas and other urban communities within Clark County, Nevada. My primary role at SNWA was to lead a group of researchers to determine the occurrence, fate, and treatment efficacy of emerging environmental contaminants in water. With a decade of experience at SNWA and over 15 years as an engineering professor, I have become proficient in the issues surrounding the supply, treatment, regulation, and delivery of municipal water. I have been the Principal Investigator for numerous projects related to emerging contaminants in water and have served on several expert panels and committees related to water quality in the United States (US) and abroad. I was a member of the National Academy of Science's National Research Council expert panel on water reuse and was appointed to the US Environmental Protection Agency (EPA) Science Advisory Board Drinking Water Committee. I have previously served on two US EPA advisory committees on endocrine disrupting chemicals and was a member of two US EPA expert panels for the Contaminant Candidate List. I have conducted extensive research related to trace contaminants in water supplies and have authored or co-authored over 300 manuscripts, reports, and book chapters during my career, which have been cited more than 41,000 times. The US Senate Committee on Environment and Public Works invited me to testify in April of 2008 as one of six national experts on the occurrence and relevance of trace pharmaceuticals in US drinking water. In 2021, I was ranked in the top 2% of scientists globally in the field of environmental engineering (ranked #55 out of 42,482). I was also awarded the 2021 Clarke Prize

for distinguished work in the field of water science. More details of my career are provided in my CV (Appendix A).

I have received the following degrees from accredited colleges and universities:

1. Bachelor of Arts (B.A.) degree in Chemistry with a minor in Medical Biology from Thiel College in Greenville, Pennsylvania
2. Doctor of Philosophy (Ph.D.) in Zoology and Environmental Toxicology from Michigan State University in East Lansing, Michigan.

Opinions Regarding the Expert Report from Issam Najm, Ph.D., P.E., BCEE

In his report, Dr. Najm renders opinions regarding two primary questions posed by the counsel for Plaintiff: (i) will the proposed solution achieve permit compliance? (ii) is granular activated carbon (GAC) the only treatment solution, or should an alternative solution be considered?

Regarding Dr. Najm's opinion on "*will the proposed solution achieve permit compliance?*"

Dr Najm states that "*Based on my analysis of the current concentrations of PFOA and GenX in the discharge at each outlet, and the expected reduction in mass load, and thus concentrations, there is a very low likelihood that the planned solution will meet the numerical limits of the 2018 Permit.*"

Dr Najm also states that "*Table 3 presents the percent reductions in GenX and PFOA average loads at outlets 001, 002, and 005 presented by DEFENDANT in the Supplement to the AA&IP (April 3, 2025). Without changes in the flowrate at each outlet, these reductions can also be used to represent the percent reductions in the concentrations of GenX and PFOA at each outlet after*

the treatment systems are installed. For Outlet 006, the Supplement to the AA&IP of April 3, 2025, did not list a percent reduction value. Based on my calculations, the average annual mass loads, and thus concentrations, of GenX and PFOA at 006 will be reduced by 3.3% and 4.3%, respectively, after the treatment system for the West Pad Stormwater flow is in place and performing as claimed by DEFENDANT." Dr Najm's Table 3 is reproduced below as Figure 1.

Table 3 –Percent Reductions in the Average GenX & PFOA Loads at Outlets 001, 002, and 005 as Presented by DEFENDANT in their Supplement to the AA&IP (April 2025)

Outlet	GenX	PFOA
001	79%	3%
002	16%	3%
005	66%	1%

Figure 1: Screen Capture of Dr. Najm's Table 3.

A summary of the information in the different tables of the Supplement to the AA&IP and estimated percent reduction is presented in the following Table 1:

Table 1: Summary of HFPO-DA and PFOA current and estimated future loads by outlet and future predicted average concentration by outlet present in the Supplement to the AA&IP of April 3, 2025. [a] – Report Only; Permit AML concentrations in µg/L. Annual Mass loading in pounds/year.

Outlet	Average Annual Mass Loading by Outlet and Flow Type (Table 6)		Estimated Future Annual Mass Loading by Outlet and Flow Type (Table 9)		Estimated % Reduction (Table 9/Table 6)		Future Predicted Average Concentrations by Outlet (Table 10)		2018 Permit AML	
	HFPO-DA	PFOA	HFPO-DA	PFOA	HFPO-DA	PFOA	HFPO-DA	PFOA	HFPO-DA	PFOA
001	1.4	0.27	0.6	0.26	57.1%	3.7%	1.03	0.26	1.4	2
002	39	12	31	10	20.5%	16.7%	1.02	0.52	1.4	2
005	98	26	33	18	66.3%	30.8%	0.22	0.12	1.1	0.3
006	0.61	0.23	0.59	0.22	3.3%	4.3%	TBD	TBD	0.14	[a]

I find Dr Najm's assessment to be incomplete and he fails to consider information presented elsewhere within the very report he has cited, *"Supplement to the AA&IP of April 3, 2025"*. ("Supplemental AA&IP"). While Dr Najm cites information presented in "*Table 8: Estimated Load Reductions of Treatment Approach*", he fails to explain exactly how his percent reductions were derived, which makes it difficult to evaluate his conclusions. For example, the existing loading at Outlet 002 is 39 and 12 lb/yr for HFPO-DA and PFOA, respectively, as shown in Table 4 and Table 6 of the Supplemental AA&IP. The future anticipated loading at Outlet 002, after treatment projects are implemented, is 31 lb/yr and 10 lb/yr for HFPO-DA and PFOA, respectively, as shown in Table 9 of the Supplemental AA&IP. This represents a percent reduction of 21% and 17% for HFPO-DA and PFOA, respectively, at Outlet 002.

The analysis of potential reductions at Outlet 006 is similarly faulty. Dr. Najm apparently only considered reductions arising from placing a cap on the West Pad, which is within the Outlet 006 stormwater drainage area, and the mass loading effects of which can be easily quantified. However, the majority of the reductions at Outlet 006 will come from collecting and treating stormwater. The treatment approach at Outlet 006 involves capturing stormwater from the drainage area to Outlet 006 in a proposed stormwater basin (or a portion of the drainage area, based on feasibility and siting of the proposed stormwater basin, to be determined during the design process) and treating the captured stormwater with a gravity flow GAC treatment system prior to discharge via Outlet 006. The capture and treatment of stormwater from the Outlet 006 drainage area has not yet been quantified but would be expected to capture approximately the 2-year, 24-hour design storm, which is the 24-hour rainfall depth with a 2-year recurrence interval. The assessment in Dr. Najm's report does not account for this planned treatment project. While the

exact reductions in HFPO-DA and PFOA are unknowable until the project design is completed, any treatment system that is collecting stormwater and treating it will greatly reduce concentrations of HFPO-DA and PFOA in the stormwater. Concluding that the violations necessarily will continue after treatment is unreasonable.

Perhaps most importantly, Dr. Najm's assessment ignores other important factors presented in the Supplemental AA&IP of April 3, 2025. The AA&IP projects are complemented by additional reductions would be obtained from the Pollutant Minimization Program (PMP) that would help eliminate precipitation-induced spikes and similar contributions to daily maximum exceedances. From the executive summary of the Supplemental AA&IP: "The Supplemental Plan describes proposed actions including a [PMP] that Chemours will perform at the Site such that discharges from Outlets 001, 002, 005, and 006 (the outlets) meet the Site's 2018 NPDES permit limits…" and "After completion of the actions described herein, 2018 NPDES permit average monthly limits (AMLs) are anticipated to be met. Additional concentration reductions in stormwater flows are also anticipated based on implementing a PMP. If during PMP action implementation outlet sampling data shows compliance with 2018 permit maximum daily limits (MDLs) is not being achieved, additional treatment approaches will be evaluated and the PMP will be executed as an iterative process of evaluations, investigations, and implementations to lead to compliance with 2018 permit limits." Such reductions, along with additional air emission controls, should have been considered by Dr. Najm instead of limiting himself to the Supplemental AA&IP projects.

Dr. Najm also does not consider current versus future discharge outlets for the different waste streams. Chemours has proposed that Outlet 006 become a stormwater only outlet with some of the current flow being redirected to outfall 003. Flows from the monomer Neutralization

Tank, B162 Targeted Process Water, and W 9 Line 1 will also be redirected from Outlet 002 to Outlet 005. Such changes are presented in Table 8 of the Supplemental AA&IP, and should have been considered, or at least acknowledged, by Dr. Najm.

Dr. Najm states that *"Without changes in the flowrate at each outlet, these reductions can also be used to represent the percent reductions in the concentrations of GenX and PFOA at each outlet after the treatment systems are installed."*

Dr. Najm's assessment therefore fails to recognize the sum of all the potential reductions that are being evaluated and developed at Washington Works, and he does not fully account for all the potential changes in loading that are expected to occur. As such, his simplistic approach of calculating and applying the percent reduction is not appropriate, as can be seen in Figure 1 of his report:

Figure 3: Reproduction of Dr. Najm's report Figure 1.

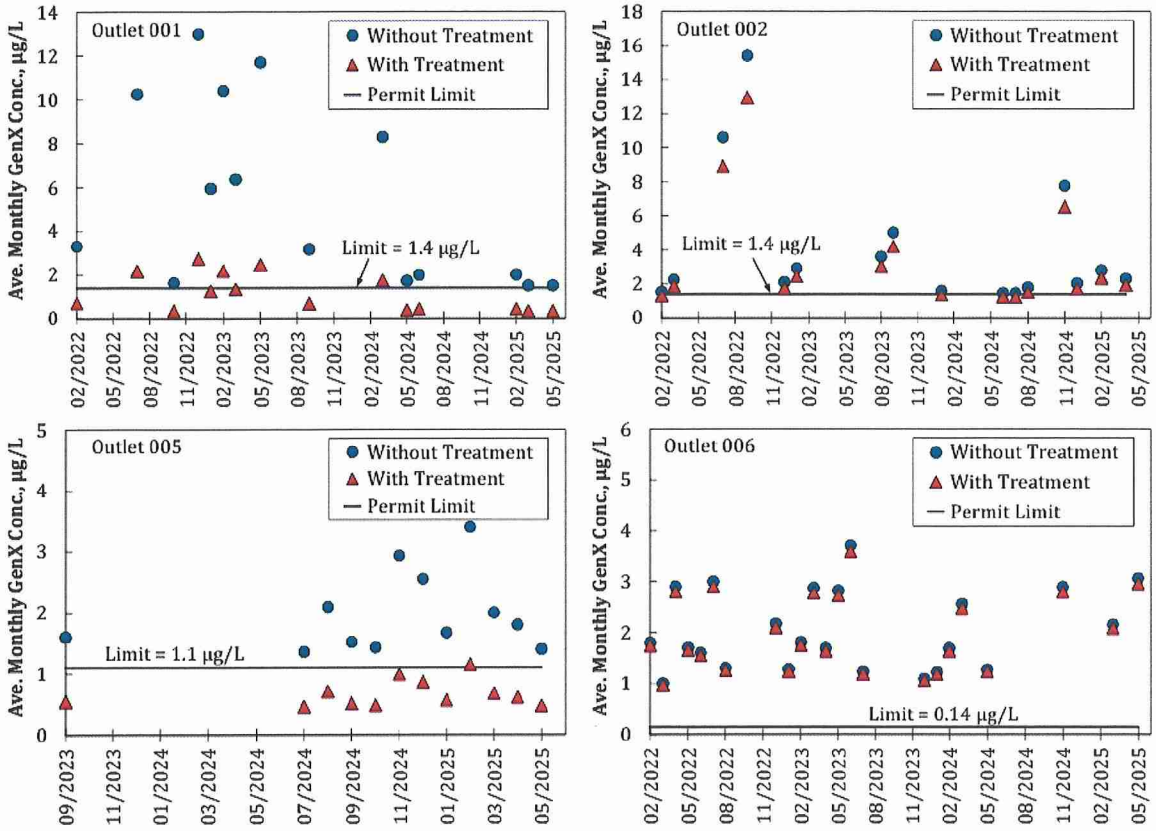


Figure 1 – Historical Concentrations of Average Monthly GenX Discharge Levels at Outlets 002, 003, 005, and 006 (during Exceedances) Compared to the Levels that Would have been present in the discharge streams Even with the Implementation of the Treatment strategy proposed by DEFENDANT

Note that Outlets 001 and 005 (top and bottom left panels), with realization of the reductions from the Supplemental AA&IP projects, would have been largely in compliance for the past two years. Outlets 002 and 006 (top and bottom right panel) are using the wrong percentage reductions, as explained more fully above. Therefore, achieving permit compliance is feasible. Further, none of these calculations factor in the effects of PMP projects that are being implemented at present.

The expected concentrations presented in Table 10 of the Supplemental AA&IP are considered the most appropriate estimates of estimated future average concentrations after completion of projects.

Table 10: Future Predicted Average Concentrations by Outlet

Outlet	HFPO-DA		PFOA	
	2018 Permit AML	Estimated Future Average Concentration (ng/L)	2018 Permit AML	Estimated Future Average Concentration (ng/L)
001	1,400	1,030	2,000	260
002	1,400	1,020[3]	2,000	520
005	1,100	220	300	120
006	140[1]	To be determined[2]	Report only	To be determined[2]

Figure 2: Reproduction of Table 10 of the Supplement to the AA&IP of April 3, 2025

Considering the entirety of the Supplemental AA&IP, including the PMP and other changes proposed, I disagree with Dr. Najm's conclusion that the Chemours cannot achieve permit limit compliance following implementation of the described measures.

Regarding Dr. Najm's opinion on *"is GAC the only treatment solution, or should an alternative solution be considered?"*

Dr. Najm's question is surprising, given the evidence that Chemours engaged in robust analysis of treatment options. It is noteworthy that there is abundant evidence that alternative solutions were considered. The Geosyntec report dated December 2024 (WVRC-CC00057069) – "*Attachment 25c – Treatment Process Wastewaters: Factor for Technology-Based Effluent Limits*", Geosyntech and AECOM report, "*Alternatives Analysis & Implementation Plan for Outfalls 001, 002, 005 and 006*" of August 24, 2023 and the *"Supplement to the AA&IP of April*

3, 2025" all report on consideration of different technologies: granular activated carbon (GAC), ion exchange (IX) and regenerable ion exchange (RIX), and reverse osmosis (RO).

In a multicriteria assessment, summarized in Table 7 of the Supplement to the AA&IP, GAC technology was determined to be the most favorable technology for PFAS treatment. Criteria summarized include potential treatment effectiveness, technology maturity, degree of adoption for PFAS, potential applicability, waste generation, complexity, and commercial availability. Figure 5 below reproduces Table 7 from the Supplemental to the AA&IP and demonstrates why GAC was selected as the best treatment technology.

Table 7: Treatment Technology Evaluation

PFAS Treatment Technology	Granular Activated Carbon (GAC)	Ion Exchange Resins (IX)	Regenerable IX (Regen-IX)	Reverse Osmosis (RO)
Potential Treatment Effectiveness	1	1	1	2
Technology Maturity	1	1	2	1
Degree of Adoption for PFAS	1	2	2	3
Potential Applicability	1	1	1	3
Waste Generation	1	2	1	3
Complexity	1	2	3	3
Commercial Availability	1	1	3	1

Legend:
1 – most favorable; 2 – intermediate; 3 – least favorable

Figure 3: Reproduction of Table 7 - Treatment Technology Evaluation from the Supplement to the AA&IP.

Najm - Page 7 – *"I am not aware of any data or information provided by DEFENDANT to quantify the removal of PFOA or GenX by the proposed GAC treatment systems from any of the waste discharge streams."*

The opinion rendered by Dr. Najm does not reflect the information available. One of the documents considered by Dr. Najm, the Supplemental AA&IP (Section 3.2.2) clearly refers to treatability testing. Additionally, testing data on multiple waste streams from Washington Works Wood Country, West Virginia using GAC and accelerated column tests (ACTs) using Calgon's Filtrasorb 400 (F400) are presented in WVRC-CC-00065259, WVRC-CC-00065270, WVRC-CC-00065279, WVRC-CC-00065284, WVRC-CC-00065291, WVRC-CC-00065303, WVRC-CC-00065615, WVRC-CC-00065947, WVRC-CC-00065961, WVRC-CC-00065970, WVRC-CC-00065981, WVRC-CC-00065991 and WVRC-CC-00066351. In the ACT different wastewater, stormwater, and groundwater samples from Chemours Washington Works Plant in Wood Country, West Virginia were tested using GAC. Results of that testing can be used to predict the volume breakthrough curve for the full-scale adsorber and therefore allow for an efficient system operation with changes in the GAC bed before breakthrough. This is clear evidence that the GAC systems were fit for purpose.

Indeed, any water treatment system's effectiveness depends on proper operation and maintenance, and wastewater treatment is no exception. Some of the concerns about GAC highlighted by Dr. Najm, such as the high TOC of some streams, are also concerns for other treatment options, and in any event can be effectively managed since information on volume breakthrough is available. In fact, GAC for PFOA and GenX removal has been extensively studied and challenges with breakthrough can be managed with proper system operation (Belkouteb et al., 2020; Medina et al., 2022; Nakazawa et al., 2023; Rodowa et al., 2020). Furthermore, Chemours Washington Works Plant in Wood Country, West Virginia has conducted ACT tests with GAC on its own waste streams, the best test of all, to develop the optimal treatment process (WVRC-CC-00065259, WVRC-CC-00065270, WVRC-CC-00065279, WVRC-CC-00065284, WVRC-CC-

00065291, WVRC-CC-00065303, WVRC-CC-00065615, WVRC-CC-00065947, WVRC-CC-00065961, WVRC-CC-00065970, WVRC-CC-00065981, WVRC-CC-00065991 and WVRC-CC-00066351).

Najm - Page 7 – "For *the above reasons, I believe that, at a minimum, DEFENDANT has not made the case for selecting GAC over IX resin for PFOA and GenX removal from any of the waste streams".*

The record in this case is replete with explanations about why GAC is equal to, or superior to, other forms of treatment. Among other things, a treatment technology review is presented within a report from Geosyntec dated from December 2024 (WVRC-CC00057069) – *Attachment 25c – Treatment Process Wastewaters: Factor for Technology-Based Effluent Limits*. Both GAC and IX (including RIX) and RO are reviewed. Benefits of the selection of GAC (both economic and non-economic attributes) over IX are clearly highlighted. Considering the requirements for best available technology (BAT) evaluation in 40 CFR 125.3(d)(3) and information provided in the Geosyntec report, selecting GAC as BAT for the Chemours Washington Works Plant in Wood Country, West Virginia is reasonable and well-justified.

Additionally, previously published manuscripts demonstrated that GAC and IX resins can treat similar volumes of water prior to breakthrough of PFAS, suggesting that GAC and IX are similarly effective treatment technologies for GenX and PFOA abatement (Liu et al., 2022). The importance of operational parameters and treatment system management over removal efficiency when selecting GAC or IX has also been published previously (Medina et al., 2022; Murray et al., 2021).

As also highlighted by Geosyntec (WVRC-CC00057081), most IX resins are single use sacrificial applications that generate a solid waste which must be subsequently disposed. Reactivation of GAC tends to occur at much lower temperatures than that of the temperature needed for the disposal of IX resins. Both resins mentioned by Dr. Najm, namely DuPont (PSR2 Plus Resin) and Kuraray (CalRes 2301 Resin) are single use products and not regenerative IX (RIX).

Ion exchange (IX) is also subjected to different interferences of the water matrix, including elevated organic matted content (TOC) (Dixit et al., 2019; Dixit et al., 2021; Gagliano et al., 2020). Indeed, both organic batter and certain inorganic species such as sulphate, nitrate and phosphate ion can be captured by IX, thus reducing its effectiveness. For inorganics, complicated effects exist when using IX, such as adsorption through electrical double-layer compression, surface-charge neutralization, divalent cation bridging effect, salting-out, and competitive adsorption (Du et al., 2014). For organic matter, PFAS can be significantly impacted by the organic matter charge density and by the molecular weight distribution (Dixit et al., 2019; Dixit et al., 2021; Maimaiti et al., 2018).

Both technologies have been the subject of extensive academic research, including original work by my own research group (Park et al., 2020a; Park et al., 2020b). There is nothing about IX or RIX that would make it inherently better in this context. In addition, a full and fair comparison of treatment systems would require analysis of other system characteristics that need to be evaluated when choosing a treatment technology, such as age of equipment and facilities, process employed, engineering aspects of the application of control techniques, process changes, non-water quality environmental impact (including energy requirements), and life-cycle costs. Dr. Najm has not undertaken that sort of analysis and has shown no clear and comprehensive evidence

of IX as a superior alternative to GAC for Chemours Washington Works. Considering the entirety of the Supplemental AA&IP and ACT testing of different waste streams, GAC is an effective means of managing PFOA and HFPO-DA at the Washington Works plant. The selection of GAC over IX, regenerable ion exchange (RIX), or reverse osmosis (RO) is clearly substantiated.

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Park, M., Wu, S., Lopez, I.J., Chang, J.Y., Karanfil, T. and Snyder, S.A. 2020b. Adsorption of perfluoroalkyl substances (PFAS) in groundwater by granular activated carbons: Roles of hydrophobicity of PFAS and carbon characteristics. Water Research 170, 115364.

Appendix A: Snyder CV and Prior Testimony in Past Five Years

Shane A. Snyder, Ph.D. BCES

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Education

1994-2000	**Michigan State University, East Lansing, Michigan** Doctorate of Philosophy: Environmental Toxicology and Zoology Dissertation Title: ***Instrumental and Bioanalytical Measures of Endocrine Disruptors in Water*** *Advisor:* Dr. John P. Giesy (Distinguished Professor)
1990-1994	**Thiel College, Greenville, Pennsylvania** Department of Chemistry Bachelor of Arts: *Magna Cum Laude* Major: Chemistry Minor: Medical Biology

Employment Experience

1998-Present	**Owner/Consultant.** Total Environmental Solutions Inc. then Total Environmental Solutions LLC. Provide professional consultation, expert witness services, and build teams of experts capable of solving a diversity of challenging environmental issues.
2024-Present	**Georgia Institute of Technology (Georgia Tech) – USA: José Domingo Pérez Foundation Chair Professor (Civil & Environmental Engineering).** Engaging students and research fellows to advance knowledge and leadership in environmental sustainability. Emphasizing leading edge research on the occurrence, fate, and relevance of pollutants on human and environmental health.
2018-2024	**Nanyang Technological University (NTU) – Singapore: Professor (Civil & Environmental Engineering, President's Chair, Lee Kong Chian School of Medicine).** Educating students and research fellows in the areas of environmental sustainability, including pollution detection, fate & transport, remediation, and health risk assessments. Principle investigator on numerous government and private sector research grants.
2018-2024	**Nanyang Environment & Water Research Institute (NEWRI) at NTU: Executive Director.** Senior leadership position of NEWRI with five centers and core analytical & engineering facilities. Overseeing operations for over 300 faculty, staff, fellows, and students. Align fundamental research discoveries from world's leading scientists to implementation and commercialization in key market segments. Managing a budget of approximately $25M USD/year and engaging with industrial and governmental stakeholders.
2010-2021	**University of Arizona – Professor of Chemical and Environmental Engineering.** Provide leadership and teaching in the areas of water treatment, contaminant fate and transport, and public/environmental health implications of water pollution.
2010-2019	**Arizona Laboratory for Emerging Contaminants (ALEC) – Co-Director.** State-of-the-art analytical facility at University of Arizona with a focus on identification and quantification of emerging contaminants, such as pharmaceutical, endocrine disrupting compounds, and nanoparticles.

2013-2018	**Water & Energy Sustainable Technology Center (WEST) – Co-Director.** The WEST Center represents a new facility that fosters collaboration among University of Arizona faculty, students, and staff with public and private sector partners. The WEST Center has achieved an agreement with Pima County Water Reclamation to construct a new ≈24,000 ft^2 facility for pilot-scale technology testing and laboratory evaluations in addition on multiple acres of outdoor demonstration-scale capabilities.
2000-2010	**Research and Development – Project Manager.** Southern Nevada Water Authority, Las Vegas, Nevada. Develop and manage diversity of drinking and wastewater projects related to emerging contaminants, conventional and advanced treatment technologies, and modern analytical method development. Achieve external research funding to support team of chemists, engineers, graduate students, and post-doctoral researchers.

Funded and Research Projects

2023 - 2025	**Principal Investigator** - Continental Tire Corporation, Germany: "Mitigation of tire wear particles (TWPs) impacts on freshwater and engineered systems for drinking water."
2023 - 2024	**Principal Investigator** - Merlion Programme: "Mitigation of tire leachate impacts with smart urban planning in resilient cities"
2022 - 2024	**Collaborator** - Reimagine research fund: "Preparing for the next pandemic - assessment of environmental influenza viruses, co-infection and host responses in the post-COVID19 era"
2022 to 2025	**Principal Investigator -** Investigation of IXOM MIEX Waste Brine Treatment and Upcycling for Zero Liquid Discharge Applications
2022 to 2025	**Principal Investigator -** Investigation of UV-NH2Cl for Reverse Osmosis Permeate Disinfection including Municipal Wastewater Recycling and Seawater Desalination
2022 to 2024	**Principal Investigator** – Singapore PUB: "Integrated methods of biological analysis and effect-directed analysis (EDA) to guide safe reuse of water"
2022 to 2025	**Principal Investigator** – Singapore PUB: "Development of membrane integrity monitoring and control algorithms for dissolved air flotation, oxidation process control through differential UV and fluorescence monitoring"
2022 to 2023	**Principle Investigator -** Mitigation of tire leachate impacts with smart urban planning in resilient cities.
2022 to 2023	**Co-Principal Investigator** – Agency for Science, Technology and Research: "Fate of Biodegradable Packaging Film with Aluminum Foil Providing Best-In-Class Moisture Barriers for Moisture Sensitive Solid Formulas"
2022 to 2023	**Principal Investigator** – Lavender Management Limited: "Cigarette waste for renewable cellulose: valorization and characterization"
2021 – 2026	**Principal Investigator - Singapore National Research Foundation (NRF):** Centre of Excellence Program, Nanyang Environment and Water Research Institute Tranche 4 (S$92.9M)
2022	**Principal Investigator – National University of Singapore (through Minderoo Foundation):** "Detection of heavy metals in dried shark fins to model the species composition of shark fin trade in Singapore"
2022 - 2023	**Principal Investigator - Crystal Clear Environmental Pte Ltd:** "Development of advanced oxidation processes targeting complex heterocyclic/phenolic substances and volatile organic compounds in industrial wastewater"
2021	**Principal Investigator – Tessenderlo Kerley, INC.:** "Analyses for Perchlorate and Chlorate in Pesticide Formulations"

2021 - 2023	**Principal Investigator – Indah Water Konsortium SDN BHD:** "Wastewater-based epidemiology (WBE) of COVID-19 and related markers for IWK wastewater facilities"
2021	**Principal Investigator (NEWRI) – Singapore Economic Development Board (EDB):** Tranche 3 extension and capital equipment grant ($12M)
2020 to 2022	**Principal Investigator – The National Environment Agency: "**Development of Chemical Testing Protocols and Analysis of Pesticide and Repellent Products"
2020 - 2022	**Co-Investigator – Singapore PUB:** "Development of a Sustainable Treatment Process for Sludge – A Comprehensive Analysis and Comparison of Incineration and High-Temperature Slagging Gasification Processes, and The Assessment of the Residues Generated for Their Utilization as Green Construction Materials"
2020 - 2023	**Collaborator - NRF through PUB under CRP (W): "**The Integrated Optofluidic System for Fast E. Coli Detection in Drinking Water"
2020 - 2022	**Principal Investigator – Singapore PUB**: "Development of an Inline Pre-formed Chloramine (NH2CI) System for Biofouling Control in Seawater Reverse Osmosis (SWRO) Desalination Process."
2020 – 2021	**Principal Investigator - Nanostone Water, Inc (Singapore branch):** "Removal Efficiency of Coronaviruses from Water/Wastewater by Ceramic Membrane Ultrafiltration"
2020 – 2022	**Co-Investigator – Singapore PUB**: "Feasibility of Reutilization of Sewage Sludge Via Biochar"
2020 - 2022	**Principal Investigator – Singapore PUB:** "Wastewater-based Epidemiology (WBE) of COVID-19 and Related Markers in Singapore: Novel and Cost-Effective Methods for Tracking Epidemic and Endemic diseases."
2019 – 2022	**Principal Investigator - Agilent Technologies**: "Bioassay Application and Development for Environmental Quality Assessment"
2019 - 2022	**Principal Investigator - Singapore PUB**: "Investigation and Optimisation of Ozone Ceramic Membrane Process"
2019 - 2021	**Principal Investigator - Ixom Operations Pty Ltd**: "MIEX Pilot Plant Trial and Waste Brine Treatment for Reuse"
2019 - 2020	**Principal Investigator – Gradiant International Holdings Pte Ltd**: "Counter Flow Reverse Osmosis"
2018 - 2021	**Principal Investigator (NEWRI) – Singapore Economic Development Board (EDB):** Leadership of $58M core funding awarded to NTU under the "Water Research Centre Funding Scheme for development of NEWRI"
2017	**Principal Investigator – Water & Energy Sustainable Technology Center (WEST):** Numerous projects on water reuse and water quality through external funding from 14 members.
2017	**Co-Principal Investigator – WateReuse Research Foundation:** "Characterization and Treatability of TOC from DPR Processes Compared to Surface Water Supplies." (Project 15-04)
2016	**Principal Investigator – Consumer Healthcare Productions Association:** "Evaluation of the Occurrence and Fate of Common Over-the-Counter Medications"
2016	**Co-Principal Investigator – National Science Foundation:** "Increasing Water Recovery from Nanofiltration and Reverse Osmosis using Bipolar Membrane Electrodialysis and Electrochemically Promoted Fluidized Bed Crystallization"
2015-2018	**Co-Principal Investigator – Johnson & Johnson Corporation**: Asthma Protection: Mechanisms and Agents
2015	**Co-Principal Investigator – WateReuse Research Foundation:** "Advancing the Potential for Direct Potable Reuse through Novel Sensor Systems and Effective Decision Tools" Project 14-01

2015	**Co-Principal Investigator – Federal Emergency Management Agency (FEMA)**: Cancer Prevention in the Fire Service: Exposure Assessment, Toxic Effects and Risk Management
2014	**Co-Principal Investigator – Water Research Foundation:** "Assessment of Techniques to Evaluate and Demonstrate the Safety of Water from Direct Potable Reuse Treatment Facilities"
2014	**Co-Principal Investigator – WateReuse Research Foundation:** "Model Public Communication Plan for Advancing Direct Potable Reuse Acceptance"
2013-2014	**Principal Investigator – Card Technologies:** "Evaluation of Chemical and Microbial Contaminant Attenuation through Catalytic Activated Carbon"
2013-2015	**Co-Principal Investigator – Water Research Foundation:** "Core Messages for Priority Contaminants of Emerging Concern"
2013-2015	**Co-Principal Investigator – WateReuse Research Foundation:** "Tucson Water Potable Reuse Demonstration Project" (led by CH2M Hill)
2013-2014	**Co-Principal Investigator – WateReuse Research Foundation:** "Evaluation of Current and Alternative Strategies for Managing Chemicals of Emerging Concern in Water"
2012-2015	**Principal Investigator – Suez Environment:** "Investigation of Treatment Technologies for Fresh Water Reverse Osmosis Brine"
2012-2013	**Co-Principal Investigator – WateReuse Research Foundation:** "Equivalency of Advanced Treatment Trains for Potable Reuse" – Project# 11-02
2012-2013	**Co-Principal Investigator – Water Research Foundation:** "Decision Support System for EDCs and PPCPs" – Project# 4386
2012-2014	**Co-Principal Investigator – WateReuse Research Foundation:** "Monitoring for Reliability and Process Control of Potable Reuse Applications" – Project# 11-01
2012-2013	**Co-Principal Investigator – WateReuse Research Foundation:** "Role of Retention Time in the Environmental Buffer of Indirect Potable Reuse Projects" - Project# 10-05
2012-2013	**Co-Principal Investigator – Water Environment Research Foundation:** "Holistic Assessment of CECs in Wastewater & Receiving Water" - Project in conjunction with City of Sacramento, CA
2012-2013	**Principal Investigator – PWN Water, The Netherlands:** "The Potential Formation of Mutagenic Nitrogenous Compounds during UV Treatment of Waters Containing Nitrate"
2012	**Principal Investigator – PWN Technologies. The Netherlands:** "Surface Chemistry and Formation of Hydroxyl Radical by Ozone or Hydrogen Peroxide in Combination with Ceramic Membrane"
2012	**Co-Principal Investigator - Charoen Pokphand Foods Public Company, Bangkok Thailand:** "Studies Intended to Determine the Etiology of the 30 Day Mortality Syndrome, also Known as the Early Mortality Syndrome ("EMS")"
2012	**Principal Investigator – Consumer Specialty Products Association:** "Occurrence of DEET in Water: Analytical Confirmation and Alternative Sources"
2011-2013	**Co-Principal Investigator – WateReuse Research Foundation:** "Development of Bio-Analytical Techniques to Assess the Potential Human Health Impacts of Recycled Water" – Project# 10-07
2011-2013	**Co-Principal Investigator – California State Water Resources Control Board:** "Evaluating Bioanalytical Methods as Screening Tools for Monitoring of CECs in California Recycled Water Applications" – Administered by Southern California Coastal Water Research Project 10-096-250
2011-2012	**Principal Investigator – USGS:** "Iodinated Disinfection Byproduct Formation from Water Reuse Practices"
2011-2012	**Principal Investigator – United Water:** "Water and Energy Sustainability at United Water Facilities" – Project 11-CHE-319

2011-2012	**Co-Principal Investigator – Water Sustainability Program (University of Arizona):** Fate of Trace Organic Contaminants during Effluent Infiltration along the Lower Santa Cruz River – Effects on Aquifer Water Quality"
2011	**Principal Investigator – Southern California Coastal Water Research Project:** "Screening Study for Constituents of Emerging Concern (CECs) in Selected Freshwater Rivers in the Los Angeles Region" Funded by California State Water Resources Control Board 10-085-140
2010-2011	**Principal Investigator – WateReuse Research Foundation:** "Use of UV and Fluorescence Spectra as Surrogate Measures for Contaminant Oxidation and Disinfection in the Ozone/H2O2 Advanced Oxidation Process" – Project# 09-10
2010-2011	**Co-Principal Investigator – WateReuse Research Foundation:** "Effect of Prior Knowledge of Unplanned Potable Reuse on the Acceptance of Planned Potable Reuse" – Project# 09-01
2010-2011	**Principal Investigator – Water Sustainability Program (University of Arizona):** "Parallel Evaluation of Ozone and UV Advanced Oxidation for Reducing Toxicity in Reclaimed Water"
2009-2011	**Principal Investigator – WateReuse Research Foundation:** "Use of Ozone in Water Reclamation for Contaminant Oxidation" – Project# 08-05
2009-2011	**Co-Principal Investigator – Water Environment Research Foundation:** "Trace Organic Compounds Removal during Wastewater Treatment – Categorizing Wastewater Treatment Processes by their Efficacy in Reduction of a Suite of Indicator TOrCs" – Project# CEC4R08
2009-2011	**Principal Investigator (with Brett Vanderford – SNWA Research Chemist) – Water Research Foundation:** "Evaluation of Analytical Methods for EDCs and PPCPs via Interlaboratory Comparison" – Project# 4167
2009-2011	**Principal Investigator (with Benjamin Stanford – SNWA Post-Doctoral Researcher) – WateReuse Foundation:** "Pilot-Scale Oxidative Technologies for Reducing Fouling Potential in Water Reuse and Drinking Water Treatment Membrane Systems" – Project# 08-008
2008-2009	**Principal Investigator – American Water Works Association/American Water Works Association Research Foundation:** "Hypochlorite – An Assessment of Factors That Influence the Formation of Perchlorate and Other Contaminants" – Project# 712/4147
2008-2010	**Principal Investigator – American Water Works Association Research Foundation:** "Role of bromamines on disinfection byproduct formation and impact on application of chloramination and ozonation" – Project# 4159
2007-2009	**Principal Investigator – WateReuse Foundation:** "Comparisons of Chemical Composition of Reclaimed and Conventional Waters" Project# 06-006
2007-2008	**Principal Investigator – WateReuse Foundation:** "Identifying Hormonally Active Compounds, Pharmaceutical Ingredients, and Personal Care Product Ingredients of Most Health Concern From Their Potential Presence in Water Intended for Indirect Potable Reuse" Project# 05-005
2007-2009	**Principal Investigator (with Fernando Rosario – SNWA Post-Doctoral Researcher) – WateReuse Foundation:** "Optimization of Advanced Water Treatment Processes for Water Reuse" Project# 06-012
2006-2009	**Co-Principal Investigator – WateReuse Foundation:** "Development of Surrogates To Determine The Efficacy Of Groundwater Recharge Systems For The Removal Of Trace Organic Chemicals" Project# 05-004
2007-2009	**Co-Principal Investigator – American Water Works Association Research Foundation:** "Low Dose Risks from Bromate: The Relationship between Drinking Water Concentrations and the Actual Dose to Susceptible Organs in Rats and Humans" Project#4042
2005-2007	**Co-Principal Investigator – WateReuse Foundation:** "Reaction Rates and Mechanisms of Advanced Oxidation Processes for Water Reuse" Project# 04-017

2005-2006	**Principal Investigator – American Water Works Association Research Foundation:** "Comprehensive Utility Guide for Endocrine Disruptors and Pharmaceuticals in Drinking Water" Project# 3033
2004-2006	**Principal Investigator – American Water Works Association Research Foundation and WateReuse Foundation:** "Toxicological Relevance of EDC and Pharmaceuticals in Drinking Water" AwwaRF # 3085 & WRF 04-003
2004-2006	**Co-Principal Investigator – WateReuse Foundation:** *Colorado School of Mines as PI* "Development of Indicators and Surrogates for Chemical Contaminant Removal during Wastewater Treatment and Reclamation" Project# WRF-03-014
2004-2006	**Co-Principal Investigator – WateReuse Foundation:** *Carollo Engineers as PI* "Reclaimed Water Aquifer Storage and Recovery: Potential Changes in Water Quality" Project# WRF-03-009
2004-2006	**Co-Principal Investigator – Water Environment Research Foundation:** *Colorado School of Mines as PI.* "Contributions of Household Chemicals to Sewage and their Relevance to Municipal Wastewater Systems and the Environment" Project# 03-CTS-21UR
2002-2005	**Principal Investigator - American Water Works Association Research Foundation:** "Evaluation of Conventional and Advanced Treatment Processes to Remove Endocrine Disruptors and Pharmaceutically Active Compounds" Project #2758
2001-2004	**Principal Investigator - Strategic Environmental Research and Development Program (for Department of Defense):** "Toxicological Impact of Ammonium Perchlorate on Fish" Project# 1222

Invited Presentations and Seminars (Since 2020)

November 2024	**Seoul, Korea:** 14th International Conference on Environmental and Public Health Issues in Asian Mega-cities "Ensuring the Safety of Potable Water Reuse" 14th November
October 2024	**Guadalajara, Mexico:** Congreso Nacional e Internacional DE LA ASOCIACIÓN MEXICANA DE HIDRÁULICA "Desafíos y oportunidades para la Sostenibilidad del Agua: el Papel de la Reutilización del Agua" 24th October
October 2024	**Stockholm, Sweden:** Micropollutant Symposium "Toxicity and Environmental Impact of Treatment Technologies" 3rd October
September 2024	**Beijing, China:** RCEES Chinese Academy of Sciences "Ensuring the Safety of Potable Water Reuse" 23rd September
September 2024	**Tianjin, China:** Society of Toxicology and Chemistry, Asia-Pacific. "Exploring the Great Unknown: New Tools to Assess Complex Environmental Mixtures." 22nd September
September 2024	**Munich, Germany (Virtual):** International Seminar 'Safeguarding the Planet's Water Supply' together with Prof Jorg Drewes, Technical University of Munich "Reinventing the urban water infrastructure – a U.S./German perspective"
August 2024	**Toluca, Mexico:** HACIA UN NUEVO MODELO DE GESTIÓN DEL AGUA XXII Ordinary Session of the Lerma Chapala Basin Council "Aguas Regeneradas: Caso Singapur." 7th August
June 2024	**Singapore International Water Week:** Two Invited Keynote Lectures, "Water Technology: Where have we been & Where should we focus" and "Exploring the Great Unknown: New Tools to Assess Complex Environmental Mixtures."
April 2024	**Riyadh, Kingdom of Saudi Arabia:** Saudi Water Forum "Sustainable Solutions to Address Water Scarcity" 29th April – 1st May 2024
April 2024	**Chengdu, China:** The 7th International Conference on Water Cycle "Exploring the Great Unknown: New Tools to Assess Complex Environmental Mixtures" 12-14th April
March 2024	**Singapore:** 12th International Singapore Lipid Symposium "Exploring the great unknown: new tools to assess complex environmental mixtures" 7th March

February 2024	**Singapore:** Health and Environment Research Outreach Workshop "Exploring the Great Unknown: Rapid Evaluation of Water Safety Using In Vitro Bioassays" 8th February
Jan 2024	**Monterrey, Mexico:** Contaminantes emergentes en agua: desafíos y soluciones "Ensuring the Safety of a Diverse Water Portfolio in a Rapidly Changing Climate" 18th January
Nov 2023	**Frankfurt, Germany:** International Conference "Towards a Global Wastewater Surveillance System for Public Health" 15-17th November 2023
Nov 2023	**Zurich, Switzerland:** Micropollutant Symposium EU "Analyses of Micropollutants: What Utilities Should Know" 7-8th November 2023
Oct 2023	**Taiwan, Kaohsiung:** Invitation to be a keynote speaker 9th IWA-ASPIRE Conference & Exhibition, Oct 22-26, 2023 One Water for Smart Cities
Oct 2023	**India, Chennai:** Water Security and Climate Adaptation (WSCA 2023) from 4th to 7th October 2023 at IIT Madras, Chennai, India
Oct 2023	**Saudi Arabia, Jeddah:** Innovation Driven Desalination Conference 1-3 Oct 2023
Aug 2023	**San Francisco, USA:** Invitation to Contribute to SoC Virtual Symposium at ACS Fall 2023 National Meeting
Aug 2023	**Jakarta, Indonesia:** Invited conference keynote speaker (online) at International Conference on Applied Sciences, Education and Technology (iConASET) With the theme "Entering Society 5.0: Transformation and Efforts"
July 2023	**Salt Lake City, Utah:** Invited workshop presentation at AWWA Portable Reuse & Biological Treatment: Exploring the Great Unknown: New Tools to Assess Complex Environmental Mixtures
June 2023	**Toronto, Canada:** AWWA ACE23 Conference, The World's Premier Water Conference June 11- 14
May 2023	**Daegu, South Korea:** IWA Leading Edge Conference on Water and Wastewater Technologies 28 May – 2 June 2023 – Programme Committee for the Conference.
March 2023	**Monterrey Mexico**: Tec Science Summit - Invited keynote speaker to address the critical nature of water reuse for environmental and economic sustainability
March 2023	**Atlanta, Georgia:** WateReuse 2023 Symposium – Invited Panelist to share water reuse challenges and successes within the Southeast Asia region, also an invited presentation on the use of bioassays to monitor water quality in view of human health safety.
March 2023	**Singapore:** Invited keynote speech at the conference and serves as conference chair, 2023 4th Asia Conference on Renewable Energy and Environmental Engineering
December 2022	**Auckland, New Zealand:** Invited seminar at Watercare ("Environmental Sustainability in World's Fastest Growing Regions: Challenges and Opportunities for Water and Waste Management") and University of Auckland ("Exploring the Great Unknown: New Tools to Assess Complex Environmental Mixtures")
November 2022	**Princeton, USA:** Invited seminar at Princeton University, "Environmental Sustainability in World's Fastest Growing Regions: Challenges and Opportunities for Water Reuse."
October 2022	**Monterrey, Mexico:** Invited seminar for Tecnológico de Monterrey University, "Environmental Sustainability in World's Fastest Growing Regions: Challenges and Opportunities for Water and Waste Management."
October 2022	**New Orleans, USA:** Invited workshop presentation at WEFTEC Conference, "Exploring the Great Unknown: New Tools to Assess Complex Environmental Mixtures."
September 2022	**Vietnam:** Invited presentation at the Environment and Sustainable Development: increasing understanding and awareness of pollution to reduce impacts" training workshop (online). Presentation entitled "Exploring the Great Unknown: New Tools to Assess Complex Environmental Mixtures"

September 2022	**Singapore**: Invited lecture at the APRU Global Sustainability Course (online). Presentation entitled "Environmental Sustainability in World's Fastest Growing Regions: Challenges and Opportunities for Water and Waste Management"
September 2022	**Singapore:** Invited keynote speech at the Sustainability Learning Lab Launch. Presentation entitled "Environmental Sustainability in World's Fastest Growing Regions: Challenges and Opportunities for Water and Waste Management"
August 2022	**Singapore:** Invited keynote address at the 2022 Asia Client Forum. Presentation entitled "Exploring the effects of climate change on waters in Asia, and the risk of the changing climate."
June 2022	**Singapore**: Invited presentation at the 9th ASEAN + 3 Junior Science Odyssey 2022 (online). Presentation entitled "Environmental Sustainability in World's Fastest Growing Regions: Challenges and Opportunities for Water and Waste Management"
June 2022	**India:** Invited key note address at the Conference on Water Quality (Emerging Contaminants: Need for Action) (online). Presentation entitled "Exploring the Great Unknown: New Tools to assess Complex Environmental Mixtures"
April 2022	**China:** Invited keynote speaker at the Asian Symposium on Water Reuse (ASWR) (online). Presentation entitled "Exploring the Great Unknown: Addressing Chemical Mixtures in Reused Water"
April 2022	**Singapore**: Invited lecture for NTU Interdisciplinary Graduate Program (IGP) students (online). Presentation entitled "Environmental Sustainability in World's Fastest Growing Regions: Challenges and Opportunities for Water and Waste Management"
April 2022	**USA:** Invited Keynote Speaker at the 17th IWA Leading Edge Conference on Water and Wastewater Technologies. Presentation entitled "Technology Adaptation for Resilient and Sustainable Water"
February 2022	**Africa**: Invited speaker at the Youth Innovators Design Bootcamp 2022 (online). Presentation entitled "Environmental Sustainability in World's Fastest Growing Regions: Challenges and Opportunities for Water and Waste Management"
February 2022	**Singapore**: Invited lecture at the APRU Global Sustainability Course (online). Presentation entitled "Environmental Sustainability in World's Fastest Growing Regions: Challenges and Opportunities for Water and Waste Management"
February 2022	**USA**: Invited presentation at the Trussell Technologies, Inc (online). Presentation entitled "A New Generation of Nanofiltration Technology: Applications and Opportunities for Resilient Water Treatment"
December 2021	**USA:** Invited presentation at the Robert M. Langer Symposium. Presentation entitled "Environmental Sustainability in World's Fastest Growing Regions: Challenges and Opportunities for Water and Waste Management"
December 2021	**Hong Kong:** Invited keynote speaker at the 4th International Forum on Asian Water Environment Technology (IFAWET) (online). Presentation entitled "Deployment and Adaptation of Advanced Environmental Technology in Underserved Communities"
December 2021	**South Africa:** Invited lecture at the Young Engineers Changemakers Programme (YECP) International Masterclass Programme (online). Presentation entitled "Approaches for developing solutions to address Singapore's water needs"
November 2021	**Singapore:** Invited speaker at Agilent's Roundtable Live Panel on Wastewater Surveillance and Analysis (online). Presentation entitled "Exploring the Great Unknown: New Tools to Assess Complex Environmental Mixtures"
October 2021	**UK-Singapore**: Invited speaker at the UK-SG Water Webinar Series 3: The water cycle, reservoir and stormwater management (online). Presentation entitled "Addressing the Great Unknown: New Tools to Better Characterize Environmental Mixtures"

September 2021	**India:** Invited speaker at the ACS Publication's webinar (online). Presentation entitled "Challenges and Opportunities for Environmental Sustainability in World's Fastest Growing Regions"
August 2021	**The Netherlands:** Invited presentation at the GWRC COVID-19 Sewage surveillance research webinar (online). Presentation entitled "Evaluation of Occurrence and Fate of SARS-CoV-2 Virus in Waters of Singapore"
July 2021	**USA:** Invited presentation at Environmental Analysis Webinar with Metrohm (recorded presentation). Presentation entitled "Challenges of Emerging Pollutants in Water Management"
July 2021	**India:** Participated as a Distinguished Guest Faculty and delivered two invited lectures for the International Faculty Development Program (IFDP) at Chandigarh University, India (online). Presentations entitled "Exploring the Great Unknown: Analytical Tools to Evaluation Complex Mixtures" and "Deploying the Best Available Technology for Water Treatment in Underserved Communities"
June 2021	**Indonesia:** Invited speaker at the Institut Teknologi Bandung-American Chemical Society (ITB- ACS) Virtual Meeting on Water Research (online). Presentation entitled "Implementation of Best Available Technology in Communities of Greatest Needs: Challenges and Opportunities"
June 2021	**USA**: Invited presentation at the Department of Homeland Security/National Institute of Standards and Technology (DHS/NIST) Workshop: Standards to Support an Enduring Capability in Wastewater Surveillance for Public Health (online). Presentation entitled "Wastewater Based Epidemiology: Monitoring of SARS-CoV-2 and Related Markers in Singapore"
April 2021	**Malaysia**: Invited speaker at the Virtual ACS Malaysia Chapter Sharing Session 2021 (online). Presentation entitled "Implementation of Best Available Technology in Underserved Communities: Challenges and Opportunities for Sustainability" and sharing on the ACS ES&T Water Journal
April 2021	**China:** Invited Presentations for Harbin Institute of Technology, China (online). Presentations entitled "Implementation of novel technologies in the developing world", "Exploring the great unknown: Characterization of complex environmental mixtures", and "Advancing water reuse: technology, safety, and efficiency considerations"
February 2021	**Pakistan:** Invited guest speaker at "To reuse, or not to reuse, that is the question: Challenges and opportunities of wastewater reuse" webinar, Institute of Environmental Sciences and Engineering (IESE), National University of Sciences and Technology (NUST) (online). Presentation entitled "Environmental Sustainability: Challenges and Opportunities for Water Reuse"
February 2021	**USA:** Invited Presentation for Safe Water Network, New York, New York USA (online). Presentation entitled "Implementation of Best Available Technology in Underserved Communities: Challenges and Opportunities for Safe Water Supply"
November 2020	**Singapore:** Invited presentation at AI+X Symposium on "AI for Social Good" (online). Presentation entitled "Opportunities for AI in the Development of Autonomous Water Purification Systems"
November 2020	**Singapore:** Invited speaker at Emerging Technology Forum on Difficult-to-Treat Industrial Wastewater (online). Presentation entitled "Opportunities & Challenges of Advanced Oxidation Processes for Industrial Wastewater"
November 2020	**Singapore:** Invited speaker at Water for All – Sustainable Resource Management (online). Presentation entitled "Challenges and Opportunities for Deployment of Water Treatment Solutions in Southeast Asia"
October 2020	**USA:** Invited seminar at Columbia University, Department of Earth and Environmental Engineering (online). Presentation entitled "Challenges and Opportunities for Environmental Sustainability in World's Fastest Growing Regions"
October 2020	**USA:** Invited seminar at University of Nevada, Reno (online). Presentation entitled "Challenges and Opportunities for Environmental Sustainability in World's Fastest Growing Regions"

September 2020	**India:** Invited presentation at International Consortium of Water Researchers (ICWR) Webinar (online). Presentation entitled "Challenges of Emerging Pollutants in Water Management"
September 2020	**Singapore:** Invited presentation at the Agilent Science and Technology Symposium (recorded presentation). Presentation entitled "Exploring the Great Unknown: Characterizing Complex Mixtures of Environmental Contaminants"
August 2020	**Hong Kong:** Invited speaker at HKU Civil Engineering Distinguished Public Lecture (online). Presentation entitled "Challenges of Emerging Pollutants in Water Management"
August 2020	**India:** Invited speaker at ACS Science Talk: Virtual Lecture Series (online). Presentation entitled "Exploring the Great Unknown: Characterization of Complex Environmental Mixtures"
April 2020	**Bangkok, Thailand**: Invited Plenary Speaker and Publication Chair at 2020 Asia Conference on Renewable Energy and Environmental Engineering (online). Presentation entitled "Sustainability in World's Fastest Growing Regions: Challenges and Opportunities for Water and Waste Management"

Publications since 2015 (Google Scholar h-index =97 with 41,265 citations as of 21st July 2025)

2025	M Tagliavini, ZY Choong, S Leow, **SA Snyd**er, D Sun. *Holistic evaluation of the potential of hollow-fiber nanofiltration for sustainable ion-exchange brine management.* Separation and Purification Technology, 134215
2025	M Kumar, S Dogra, N Das, S Dash, A Sharma, AKR Jiménez, AD Lara, **SA Snyder**, F Kurisu. *Unlocking Sustainability: Integrating Omics for Advanced Wastewater Treatment.* Journal of Environmental Chemical Engineering, 117154.
2025	R Ning, Y Xiang, D Wang, K Zhang, Z Wei, K Xu, N Gao, S Yu, L Li, .**SA Snyder.** *From Passive to Proactive: A Novel Paradigm for Odor Control in Drinking Water.* Environmental Science & Technology 59 (20), 9861-9864.
2025	L Shen, X Liao, Y Gong, P Yan, Z Chen, **SA Snyder**. *How to Control N-Nitrosodimethylamine (NDMA) in Water Treatment: From Origins to Removal.* ACS ES&T Water 5 (4), 1514-1529.
2024	A Liangdy, P Tonanon, **SA Snyder**, RD Webster, TT Lim. *Surface-and substrate-coated catalytic membrane for mitigating interference of water matrix species in intensified micropollutant confinement oxidation.* Journal of Environmental Chemical Engineering 12(6):114750. https://doi.org/10.1016/j.jece.2024.114750
2024	Theodora Hui Yian Lee, Caixia Li, Mauricius Marques Dos Santos, Suan Yong Tan, Mithusha Sureshkumar, Khajornkiat Srinuansom, Alan D Ziegler, **Shane Allen Snyder**. Chemosphere 364:143067. https://doi.org/10.1016/j.chemosphere.2024.143067
2024	R Ning, S Yu, L Li, **SA Snyder**, P Li, Y Liu, C Togbah, N Gao. *Micro and nanobubbles-assisted advanced oxidation processes for water decontamination: The importance of interface reactions*. Water Research 265:122295. https://doi.org/10.1016/j.watres.2024.122295
2024	THY Lee, AD Ziegler, C Li, K Srinuansom, **SA Snyder.** *Riverine Pesticides in an Agricultural Catchment in Northern Thailand: With Focus on Atrazine and Metabolites*. ACS Environmental Science & Technology Water. 4(9):3758-3772. https://doi.org/10.1021/acsestwater.3c00764
2024	TZX Hong, K Tang, L You, T Chen, HT Kieu, **SA Snyder**, K Zhou. *Molecular Dynamics Study into Lithium-Ion Recovery from Battery Wastewater Using Flow Capacitive Deionization and a ZIF-8-Coated Cation Exchange Membrane.* ACS Environmental Science & Technology Water 4(8):3200-3212. https://doi.org/10.1021/acsestwater.4c00087
2024	Kanika Dogra, Dipa Lalwani, Shiwangi Dogra, Durga Prasad Panday, Nirav Raval, Murgesh Trivedi, Abrahan Mora, Misael Sebastian Gradilla Hernandez, **Shane A Snyder**, Jürgen Mahlknecht, Manish Kumar. *Indian and global Scenarios of Bisphenols A distribution and its new analogues: Prevalence & Probability Exceedance*. Journal of Hazardous Materials 477: 135128.

https://doi.org/10.1016/j.jhazmat.2024.135128

2024 Seong-Nam Nam, Byung-Moon Jun, Chang Min Park, Min Jang, Kyung-Suk Cho, Ji Yi Lee, Chanhyuk Park, **Shane A Snyder**, Ahjeong Son, Yeomin Yoon. *Removal of bisphenol A via adsorption on graphene/(reduced) graphene oxide-based nanomaterials.* Separation & Purification Reviews 53(3):231-249. https://doi.org/10.1080/15422119.2023.2242350

2024 Manish Kumar, Rob Roggema, Shiwangi Dogra, Ismael Aguilar-Barajas, **Shane A Snyder**, Hiroaki Furumai, Jürgen Mahlknecht. *Global Rise of Thirsty Cities: Defining and Redesigning the Strategies for Water Sustainability*. 4(7):2775-2778. https://doi.org/10.1021/acsestwater.4c00362

2024 A Liangdy, P Tonanon, RD Webster, **SA Snyder**, TT Lim. *Versatile Fe3O4-impregnated catalytic ceramic membrane for effective atrazine removal: Confined catalytic oxidation processes, reactive oxygen species selectivity and performance in real wastewater*. Journal of Environmental Chemical Engineering 12(3):112727. https://doi.org/10.1016/j.jece.2024.112727

2024 Qiqing Chen, Cuizhu Ma, Young Hwan Lee, Mauricius Marques Dos Santos, Min-Sub Kim, Ge Meng, **Shane Allen Snyder**, Jae-Seong Lee, Huahong Shi. *Non-negligible Toxicity to Fish in the Early Life Stages Triggered by Aqueous Leachate of Takeaway Plastic Containers*. Environmental Science & Technology 58(23):10041-10051. https://doi.org/10.1021/acs.est.4c01790

2024 M Tagliavini and **SA Snyder**. *Flux decline prediction in dead-end ultrafiltration combining fluorescence spectroscopy and mechanism-informed machine learning*. ACS Environmental Science & Technology Water 4(11):4828-4835. https://doi.org/10.1021/acsestwater.4c00473

2024 Haochen Zhang, Maoju Jiang, Peng Su, Qixiao Lv, Ge Zeng, Linqian An, Jiachun Cao, Yang Zhou, **Shane Allen Snyder**, Jun Ma, Tao Yang. *Refinement of kinetic model and understanding the role of dichloride radical (Cl2•−) in radical transformation in the UV/NH2Cl process.* Water Research 254:1214440. https://doi.org/10.1016/j.watres.2024.121440

2024 Mauricius Marques Dos Santos, Caixia Li, Shenglan Jia, Mikael Thomas, Hervé Gallard, Jean-Philippe Croué, Pascal Carato, **Shane Allen Snyder**. *Formation of halogenated forms of bisphenol A (BPA) in water: Resolving isomers with ion mobility–mass spectrometry and the role of halogenation position in cellular toxicity*. Journal of Hazardous Materials 465:133229. https://doi.org/10.1016/j.jhazmat.2023.133229

2024 Theodora Hui Yian Lee, Alan D Ziegler, Mauricius Marques dos Santos, Khajornkiat Srinuansom, Suan Yong Tan, **Shane Allen Snyder**. *Spatial and temporal patterns of emerging and persistent contaminants in a mixed-use catchment: A case study of the upper ping in Northern Thailand*. ACS Environmental Science & Technology Water 4(4):1531-1545. https://doi.org/10.1021/acsestwater.3c00634

2024 M Marques dos Santos, C Li, MH Jemain, JW Yuen, **SA Snyder.** *Removal of Human Coronavirus OC43 (HCoV-OC43) in Simulated Drinking Water Treatment Processes*. ACS Environmental Science & Technology Water 4(4):1284-1292. https://doi.org/10.1021/acsestwater.3c00351

2024 Arnoldo Armenta-Castro, Mónica T Núñez-Soto, Kassandra O Rodriguez-Aguillón, Alberto Aguayo-Acosta, Mariel Araceli Oyervides-Muñoz, **Shane A Snyder**, Damià Barceló, Jayaprakash Saththasivam, Jenny Lawler, Juan Eduardo Sosa-Hernández, Roberto Parra-Saldívar. *Urine biomarkers for Alzheimer's disease: A new opportunity for wastewater-based epidemiology*? Environment International 108:108462. https://doi.org/10.1016/j.envint.2024.108462

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Patent/TD

Therapeutic fractions and proteins from asthma-protective farm dust (WO 2021/158990 A1)

Awards and Accolades

2023 The Commendation Medal (COVID-19) National Award: Prime Minister's Office Singapore

2023 Poster Award (to Mauricius Marques dos Santos, PhD student): Gordon Research Conference - Water Disinfection, Byproducts and Health: **"High-Throughput Platforms to Study Halogenated Disinfection Byproducts in Water: Resolving Isomers with Ion Mobility Mass Spectrometry and the Role of Halogenation Position in Cellular Toxicity."**

2023 Editors' Choice Award - American Chemical Society: **"Polymer Additives to Go? Occurrence of the Rubber Additive 1,3-Diphenylguanidine (DPG) in Bottled Water**
Mauricius Marques dos Santos and Shane Allen Snyder. *ES&T Letters* **2023** 10(10):937-942

2023 Outstanding Oral Presentation Award (to Arvin Liangdy, PhD Student) – International Water Association Membrane Technology Conference: **"Process Intensification in Hybrid Oxidation-Filtration Process via Catalytic Ceramic Membrane for Micropollutant Removal."**

2022 Best Paper Award 2022: Environmental Science & Technology Letters – **"Tweak in Puzzle: Tailoring Membrane Chemistry and Structure toward Targeted Removal of Organic Micropollutants for Water Reuse**
Hao Guo, Ruobin Dai, Ming Xie, Lu Elfa Peng, Zhikan Yao, Zhe Yang, Long D. Nghiem, Shane A. Snyder, Zhiwei Wang, and Chuyang Y. Tang, *ES&T Letters* **2022** (9)4:247-257

2022	Best Paper Award: ACS Environmental Science & Technology Water – "**Deconvolution of Size Exclusion Chromatograms: New Insights into Molecular Weight Distribution of Dissolved Organic Matter in Ozone-Biological Activated Carbon** Minkyu Park, Doorae Lee, and Shane A. Snyder; *ACS ES&T Water* **2021** *1* (1), 125-133" DOI: https://pubs.acs.org/doi/10.1021/acsestwater.0c00020
2021	Clarke Prize Laureate: Athalie Richardson Irvine Clarke Prize. This award is broadly considered as one of the most prestigious awards for outstanding achievements in water science and technology.
2021	Listed among the top 2% scientists in a global list released by Stanford University - Ranked 55 out of 42482 for environmental engineering field.
2019	Featured on CNN Special "Innovative Cities: How Singapore is Using Technology to Solve Its Water Shortage." https://edition.cnn.com/2019/09/25/tech/singapore-water-technology-innovative-cities/index.html
2019	President's Chair in Water Technologies, NTU Singapore
2018	The Nanyang Humanitarian Award, NTU Singapore: Won by NEWRI Community Development (NEWRIComm).
2017	Agilent Thought Leader Award: In recognition of leadership in water sustainability, safety, and treatment. This award is part of an invitational program that promotes scientific advancement by contributing financial support, products, and expertise to influential scientists.
2016	Project of the Year Award, Arizona WateReuse Association: "Potable Reuse for Inland Locations: Pilot Testing Results from a New Potable Reuse Treatment Scheme" (Snyder as U. Arizona PI)
2016	Quentin Mees Research Award, Arizona Water Association
2016	Third most cited author from top 100 most impactful publications in field of pharmaceuticals in the environment (Sci. Total Environ., 562:391-426 – Figure 1).
2015	Dr. Pankaj Parekh Research Innovation Award from the Water Research Foundation
2014	American Academy of Environment Engineers and Scientists: Board Certified Environmental Scientist (BCES) by Eminence
2013	LuxResearch Top Academics and Institutions in Water Research – Included among "30 Leading Water Researchers" (Figure 20)
2013	Best Student Presentation Award to Tarun Anumol (Snyder Research Group): National Environmental Monitoring Conference - San Antonio, Texas
2012	Best Paper Award – Journal of the American Water Works Association

Testimony since 2020

2025	*Cumberland County, North Carolina v. The Chemours Company, FC LLC & E. I. Du Pont de Nemours and Company.* Case No. 084-004847. Deposition on 7th March 2025.
2024	*Cape Fear Public Utility Authority v. The Chemours Company FC, LLC, E. I. Du Pont de Nemours and Company, and The Chemours Company.* Case No. 7:17-CV-00195-D and Case No. 7:17-CV-00209-D. Deposition on 16th September 2024.